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CZECHOSLOVAK REVIEW OF QUALITATIVE DIAGNOSIS
FROM MASS MINIATURE RADIOGRAPHS

By B. Fuchs

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FOREWORD

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Following is the translation of an article by B. Fuchs in Rozhledy v Tuberkuloze a v Nemocech Plicnich (The Study of Tuberculosis and Pulmonary Disease), Vol 21, No 1, Prague, January 1961/

In recent years, medium size (70 by 70 mm) plate exposure have come into wider use in medicine, and above all, in phthizeological practice. This ever increasing usage has presented a problem, namely that of expending some effort to obtain maximum information, both qualitative and quantitative, when examining the plate.

In the terminology of plate reading, until now there has been no standard terminology which would describe the morphological and dynamic components of the diagnosis. In our work, we shall use the term "qualitative diagnosis". We are aware of the fact that in tuberculosis we have to recognize, in addition to types, also the developing phase of tuberculosis. Our article intends to show to what extent we are able to determine the development phase of tuberculosis with sufficient accuracy.

The problem of qualitative diagnosis has been of interest to us for some time, and some successful results with 36 by 36 mm plates have led us to attempt an accurate determination on a large group of plates (70 by 70 mm) taken in Odelec whether the results obtained up to now entitle us to diagnose qualitatively in the case of all plates without exception, for which plates the qualitative diagnosis will be confirmed upon examination, and finally, what are the reasons that in no case, even for a maximum effort, we are unable to obtain a qualitative diagnosis upon considering the plate.

Our Results

We have had qualitative diagnosis experience on a group of 27,212 soldiers radiographed in Odelec on 70 by 70 mm plates. Only 245 soldiers (0.90%) were called for a checkup. In our unit 223 were examined; in the civilian part, 17 were examined and 5 did not appear. (Tables 1-4)

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Table 1

	Number	Percent
Number of persons examined	223	
The diagnosis was not confirmed on checkup	85	38.1
The diagnosis was confirmed on checkup	138	61.9

Table 2

	Number	Percent
Diagnosis was not confirmed on checkup	85	38.1
Initially so-called tubercular diagnosis	30	13.4
Initially so-called nonspecific diagnosis	55	24.7

It is seen from Table 4 that the diagnosis of some types of tuberculosis is relatively easy. It is more difficult to determine the phase, as it depends on a number of full agreements. One may also see from the table that only in two cases has this man accurately diagnosed the phase and erroneously the form of tuberculosis. In the majority of cases the converse was true.

Table 3

	Number	Percent
The diagnosis was confirmed on control	138	61.9
Tuberculosis was confirmed	87	39.0
Nonspecific cases were confirmed	51	22.9

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Table 4

	Number	Percent
Overall number confirmed tuberculoses	69	-
On control form was confirmed	61	88.4
On control form phase was confirmed	44	66.9
On control form and phase were confirmed	42	60.9

From the obtained results one may also infer a whole series of relations between the various kinds of diagnoses of pulmonary diseases and the possibilities of qualitative diagnosis, but these would only be isolated cases and no profitable conclusions might be derived from them. We are concerned about a negative control in the case of so-called non-specific diagnoses; the greatest number of them was in the case of broncho-pneumonia and while examining hilus activity. We have already mentioned in connection with other things, that when examining for the hilus we have about 90% negative control, and here we have confirmed this conclusion.

Discussion

To diagnose qualitatively on the basis of a plate is a difficult task, one has to determine simultaneously from the plate the form, the phase, and the location of tuberculosis. It is clear that most difficult will be the determination of the phase, which will reveal the dynamics of the process and give its prognosis. This is confirmed in a certain percentage of cases. Sometimes it is difficult to distinguish between infiltration and resorption, there are more difficulties in distinguishing resorption from induration. On the other hand, it is easy to distinguish between infiltration from induration or resorption from calcification. One should not forget that the value of a plate is sometimes exaggerated and sometimes underestimated.

In addition, one may have to diagnose on the basis of part of a plate, from which one may not diagnose qualitatively conclusively -- we do not wish to speculate. This occurs mostly in borderline cases when the question is whether or not there is a finding. These doubts occur mainly in these three cases:

1. The diagnosis is negative but the examiner suspects a case,
2. There is a small point unfavorable construction which leads to the suspicion of a case, we do not wish to improvise, and use the formula, unclear or suspected case,

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3. When we are in a dilemma because it is evident when looking at the plate that there is a case, but diagnosis is difficult.

Together with the question of unfavorable configurations, there also exists the problem of different exposures. We are using a standard back-to-front projection. As far as supplementary plates are concerned, side, oblique or front-to-back, I think that on the whole in the final analysis, we may neither use them nor consider them. In 1959, in Czechoslovakia there were 32.8 plates taken for every 100 citizens above the age of fifteen and the use of additional plates would have been a luxury and the advantage would not warrant the effort. Perhaps they could be considered in the case of small series of plates, but not spread to common practice. If we were to provide two exposures for everybody instead of one, this would mean that the number of controlled people would decrease by a third, at least, and by an equal amount one would decrease the value of the plate. I think that the number of cases found from additional radiographs will not be large. In the literature one finds at most about 10% case discovery by this method, but these are the ever present departures, from small groups of examinations, without adequate proof. Before critically examining the overall state of qualitative diagnosis from the plates, let me say a few words on the possibility of using it with different size plates. One may make a general statement that the diagnosis from the plate is difficult, irrespective of the size. It seems that the difference between a good small size plate and a medium size plate is not great, the point is to have a well defined diagnosis, with emphasis on finer diagnostic details. Especially with minimal cases, sometimes an incomplete plate or a part is sufficient to attempt a qualitative diagnosis. It is questionable whether one may make a qualitative diagnosis when considering a small size plate, and also, what may be expected from the examiner in extracting all the information from it. It seems that when using small size plates we will not be able to do without the phrases: tb suspected, tumor suspected, etc. Qualitative diagnosis one may only formulate in a group of all cases not requiring control, and in the case of some secondary nontubercular cases and with negative plates.

Qualitative diagnosis plays a certain role in the interpretation, but one should not agree with a so-called "deterministic diagnosis", which necessarily leads to a "at first sight" diagnosis with all its consequences and dangers. A small size plate, when enlarged, does not become a large film and should not be regarded as such. Also, in the case of technically imperfect plates, they have to be read together with the inaccuracies in the determined dimensions. The diagnosis of the development phase, which is an inseparable part of qualitative diagnosis, as a rule is very difficult to make with small plates. It is especially difficult with minimal tuberculosis cases, where of use is only a further follow-up of the sickness. Thus it is problematic whether small size radiographs serve only to intercept unknown tuberculoses or whether they are also useful for their prognosis and for making a qualitative diagnosis. This all leads to the formulation of the question whether, if we do not make a qualitative diagnosis from a small size plate, should we regard this as due to lack of resolution, uncertainty, or the modesty of the examiner, who only dares, without his conscience bothering him, to divide the plates into positive or negative.

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As we have already mentioned elsewhere, we ourselves have attempted a qualitative diagnosis on a small series of small size plates, but with only partial success. It seems that the accuracy of qualitative diagnosis, when small size plates are used, is more of an exception than a rule, and that it is better in some nontuberculin cases than with TB itself. The difficult examination of the developing phase is, of course, true not only for the small, but also for the medium plate size. Some authors think that in order to determine accurately an active state, it is necessary to have an examination in all these cases when we are unable to exclude the possibility of an active process upon first examination. Obviously it is difficult to determine the development phase of the process in an outpatient examination. It seems that upon one examination it is difficult in many cases and sometimes impossible to confirm the activity easily or to exclude it. Here it is proper to say that to find active tuberculosis is not much more important than to find inactive TB. This is because we treat active TB in every case, while from the group of inactive, untreated TB cases we have the largest number of reactivations. This is confirmed by the fact that 17% of tuberculosis cases which appear to be dormant change after two years into contagious TB (9).

Another interesting question is the classification of a plate according to its quality. For a standard, we adopt the best picture quality, and by this we understand such a picture as gives us exhaustive information about the examined subject. According to this criterion a medium size plate is inferior to a large plate. This confirms a large number of erroneous interpretations of plates, notwithstanding the best training. One may state however, that when working with a medium size plate, one may in the future obtain equally good diagnosis certainty, such as we expect from a large plate.

The identification of isolated strata is on a small plate better than on a large one. A plate is also able to inform the examining doctor whether the process is developing or diminishing. As long as one is only interested in the interpretation of a part of the mesh, it seems that the difference between sizes is small. When examining a plate we should remember that the relevant point here is that to see a case on a plate and to interpret it accurately are two entirely different things.

The number of works on qualitative diagnosis which exclusively concern themselves with this problem is very small. Those who interpret the plates are usually satisfied with putting on the margin of their communications an added observation whether, according to their opinion, using the plate size which they are, the qualitative diagnosis is possible or not. The majority of authors reject qualitative diagnosis and none of them will attempt it seriously, as he does not believe himself in the diagnostic quality of the method. It seems that this disbelief persists even now, and qualitative diagnosis using small plates has many more enemies than friends, although today one uses mostly the medium size, which is claimed to be much more adaptable to diagnosing the case than the small size. Those who are suspicious of qualitative diagnosis maintain that the fundamental job of taking the plates is to be a preliminary method of separation of positive cases from negative ones.

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In their opinion, it is a detection method and not a qualitative one. According to them, the taking of plates is a sieve, which does not take the place of a large radiograph. The taking of plates is only able to express a suspicion that there may be an illness, a suspicion which must be confirmed or disproved by a clinical and X-ray examination. Taking of plates is not the latest innovation in roentgen diagnostics, and it is an erroneous concept to think that the miniaturized film will provide a definite diagnosis. The object of taking plates was, and is, in a wider sense, to detect all suspicious cases and in particular to detect the, up until now, undetected tuberculosis.

The opinion of the defenders of qualitative diagnosis may be briefly stated to be the belief that plate X-rays are not only an economically advantageous mass examination method, but also that the plates also lend themselves to qualitative examination. The detection of tuberculosis on the plate is the less important task; far more difficult, but also more important, is diagnosing whether in the detected case it is necessary to prescribe a cure or a control lasting months or years.

Those who are against qualitative diagnosis regard the radiograph only as a detection measure; they see nothing else in it, nor do they expect anything more from it. This observation is correct in principle, but it is a disadvantage if we are only to be certain of the definite classification from original information only after a control X-ray and clinical examination. The problem of qualitative diagnosis is of secondary importance in the majority of radiographs, and its success or otherwise is negligible by comparison with the main task of radiographs, which is to find the ill among seemingly healthy persons.

However, we think that there is a whole number of cases when we may use qualitative diagnosis, and without it we must then change the control examination completely or abandon it. One shouldn't say that qualitative diagnosis is meaningful only for those who read the plates and who themselves conduct control examinations, but also for those examining doctors who have no experience of their own in reading radiographs. We are convinced that as time goes on this technique should become as widely accepted as possible, also here in hospitals and in polyclinical practice. Then it will become necessary for a greater number of doctors to be able to read the plates than heretofore. When the hospital or the polyclinical practice has an outpatient radiograph unit, always using 35.6 by 35.6 cm plates, it will become necessary for a greater number of doctors to be able to read the plates than heretofore. When the hospital or the polyclinical practice has an outpatient radiograph unit, always using 35.6 by 35.6 cm plates, it will become necessary for the doctor to be sufficiently well qualified to read the plates of medium size so that he can reliably decide whether the process is static, developing, or diminishing.

It is true that we shall always have trouble with qualitative diagnosis, in specific as well as in nonspecific cases. On the other hand, in those two large groups there will be a large number of cases where we shall be able to make a qualitative diagnosis with full responsibility. Already in a number of cases, as for example in the case of a calcified primary complex, wet

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adhesive pleurisy, dextrocardia, situs viscerum inversus, and some heart cases; this is standard practice. Here certainly hardly anybody will say that the plate is "unclear" or "suspected". This is because one is certain of the diagnosis and knows that a control examination would be an unnecessary load on the control personnel. It is evident that it is easy to make a qualitative diagnosis in those cases and that its interpretation is done without hesitation or fear.

Generally one may say that the easiest diagnosis is of old TB processes in the calcification phase and some nontuberculous anomalies. More troublesome are the nonspecific processes, and the most difficult are tuberculosis at an ill-defined developmental stage, and finally the borderline cases between specific, nonspecific or tumor processes.

As far as tuberculosis is concerned, its examination is easiest in the case of extreme forms, with on the one hand the calcified strata, and on the other hand the cavities (caverns). It is true that certain inaccuracies are introduced when we a priori designate on a plate a cavity as a tubercular disintegration. Differential diagnosis would in our cases consider, most probably, an abscess cavity or collapsed tumor, but neither of these cases exhibit usual symptoms and would lead an inexperienced doctor to an erroneous decision.

Thus the qualitative examination of calcified strata on the one hand and cavities on the other hand is not a problem in diagnosis; a much more difficult and, at times, an impossible problem, is to distinguish between the remaining phases, i.e., infiltration, resorption, and induration, as we shall mention later in greater detail. The pathological cases arising in the examination of plates are classified by some authors into a large number of groups and subgroups, the simplest division being as follows:

1. TB confirmed, immediate examination required
2. TB confirmed, control is required
3. TB confirmed, may be definitely classified on first scrutiny as healed
4. To the other groups we allocate nontubercular cases, anomalies, and negative plates.

It is incorrect to surmise that every classification into groups and generally every systematization of interpretation of plates is an attempt to make a qualitative diagnosis. Let us recall the deliberations of the subcommittee on radiographs of the Pneumological and Phthisiological Society in Prague on 18 November 1957 where the classification scheme was divided into three groups. Here the group which required examination, according to the plan of Docent Dr. Graubner, had these four subgroups:

1. Strata and spreads
2. Infiltration
3. Mixed form
4. Collapse.

Because the determination of position was abandoned, as well as the establishing of uniform classification, we see that this classification is practically the same as the classification scheme used today, and is therefore the basis of qualitative diagnosis. It is then a question of agreement

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or personal preference whether the reader will use a classification according to the plan of Docent Dr. Graubner, or whether he will remain with the presently used classification scheme in its entirety, because he may determine the pathological changes on the plate without changing anything.

The plan of Docent Dr. Graubner is a step in this direction, and in general considers the radiographs nothing else but a crude sieve for the diseases. One should not neglect the fact that this classification simplifies the solution of the problem of qualitative diagnosis because it distinguishes among the observed forms and phases of tuberculosis.

Today the examining personnel more frequently demand of the personnel reading the plates a qualitative diagnosis, or at least an attempted diagnosis. Taking large plates causes a large number of people to be called for control, because on a larger plate we seemingly see more than we are able to interpret accurately, and because of this their value is exaggerated. More than anywhere else, here we may see that it is much easier to detect a case on a plate than to diagnose it correctly. The number of negative controls rises with the number of examined people, and today approximately 30% of people called for control have negative findings.

Before we began to work with a medium size plate in Odelec, we assumed that in comparison with the 36 by 36 mm plate the number of illegible plates would decrease, and also the number of negative controls. Although the first assumption was justified, and the number of illegible medium size plates for the first 30,000 people decreased to 0.88%, the number of negative controls did not decrease, quite the contrary, it went up.

The percentage of negative controls is too high, and it does not necessarily have anything to do with the reliability of our reading, here I only have in mind the spurious positive cases. It implies clearly that it is not possible to use qualitative analysis everywhere. Here the negative controls have to be considered to be the result of insufficient ability of personnel to interpret, often as a shortcoming of the method itself, and particularly as insufficient basis for qualitative diagnosis. The number of negative controls, which in the majority of our work is very high and passes unnoticed, should not cause us to be careless. If we introduce the progressive plates also in the polyclinics in order that they may substitute sciaskopy as much as possible, then the problem of high number of negative controls will become a distressing one.

The negative controls are the fundamental explanation for the errors, as so far, the changes on the plates, we explain by certain qualitative diagnosis, and on control we find a normal lung TB case. Why is it so? I think that this important shortcoming has two reasons. The first reason is that we make a qualitative diagnosis in all suspected or clear cases without exception and without a system which heretofore we had, namely saying that there was an "unclear" or "suspected" case which represented an examination with a certain amount of reserve which did not exclude the possibility that, upon control, there would prove to be no case. Qualitative diagnosis is at least successful in the case of those unclear or suspected plates. Therefore we diagnose somewhat qualitatively, when we are not convinced that

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the case actually exists. The other deficiency lies in the method itself. On plates we will always find certain small changes which will never be explained by any investigation methods.

We have already mentioned that qualitative diagnosis is of value to the examining personnel. Thus the examining doctor relies only on sciascopy, as he is used to the insufficiency of the film, but in my opinion in the long run the qualitative diagnosis has a decisively greater value to him, although it is sometimes more inaccurate than the simple statement: the plate is unclear, examination is required. We know that when reading the plates, or with sciascopy, it is most difficult in borderline cases to decide whether or not there is a case. In minimal and in isolated strata in particular, the radiograph is much more reliable than sciascopy, but today we still are not so advanced that we could take a large plate of everybody who is called in for control, and therefore the qualitative diagnosis is of assistance to the examining doctor.

When the examining doctor checks not fully described or classified cases, there are two possibilities open to him. Firstly, he himself may have experience in reading plates, and in borderline cases he will observe the TB process, and therefore from experience he will believe the plate rather than himself or a subjective sciascopy, and use a large plate. The second possibility is that he will satisfy himself with a sciascopy and will miss a number of small cases as long as they are not almost in the calcification phase, or will miss small cases with unfavorable position.

The problem of the method of X-ray examination of cases detected with radiographs is, generally speaking very interesting and important, and we do not wish to discredit the whole method by the fact that the cases missed by sciascopy are seen by the plate.

All control examinations may be divided into three classes:

1. Sciascopy alone
2. Combination of sciascopy and sciagraphy
3. Large plate without sciascopy

1. The first method, used widely, is inadequate. It is true that sciascopy will enable us to exclude safely a whole number of so-called suspected cases, which are mainly nonspecific. In these cases one may believe the sciascopy and do without the plate.

2. The second method is in use today, and we think it has its undeniable advantages. Here we distinguish two subcases: a) the first possibility is that we are unable to find by sciascopy the case found on a plate, b) the second possibility is that the case found on a plate is confirmed by sciascopy. In both cases we nearly always take a big plate. In the first case, because we wish to catch the omitted detail, and in the second case because the examined person either remains in an institution for treatment or is released, and the preparation of a primary large plate is the rule in both of these cases.

3. The third method is the most interesting one. At the present, this method is not in use, and should the need for a large number of plates arise, then the method may not be feasible. Its advantage would be that we would

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spare the sick the long exposure to sciascopy, and in addition we would have a permanent record of high accuracy. It seems that the last method will be widely used in the future. Overall, our plate interpretation facilities increase until everywhere it will become standard practice to have two independent readings, thus lowering to a great extent the percentage of negative controls. This in my opinion is the main reason why this method is not as yet universally accepted.

If we are to judge the present plan of qualitative diagnosis from plates, we should consider all voices for and against it, and on this basis and on the basis of one's own experience attempt to solve this problem. Let us consider our results, where the greatest problem is the negative control.

These negative controls were in the case of our readings, 13.4% with so-called tubercular cases, and about 24.7% in the case of so-called non-specific cases. One should not speak about a complete success of qualitative diagnosis where one has an average of 40% of negative controls.

As far as one's own qualitative diagnoses in confirmed tuberculosis cases is concerned, the findings are better. The agreement of our readings with actual state was 88.4% of tuberculosis forms and 66.9% of phases. Full agreement of form and phase, i.e., a full qualitative diagnosis, success was obtained in 60.9%.

I think that the systems used in qualitative diagnosis of large numbers of plates will bring about a certain improvement of our diagnostic facilities. This possibility exists as the success or failure of qualitative diagnosis implies no risk on the part of the examined person. One may therefore assume that there will not be cases where we are unable to use qualitative diagnosis. However, the number of negative controls will be smaller, and this is the main disadvantage of qualitative diagnosis.

We shall conclude by saying that qualitative diagnosis, although it is more or less successful, does not influence the accuracy of detecting tuberculosis and that more urgent than qualitative examination is an early examination of the case with all the means at one's disposal, so that the time lapse between the detection of the case, a control examination and the possible beginning of a treatment would be decreased to a minimum. Thus we see that one of the main tasks of qualitative diagnosis is to determine as soon as possible the degree of seriousness of the case and the necessity of an early control examination. This, however, with the risk that the qualitative diagnosis will in many cases be only a probable one. For the examining doctors, qualitative diagnosis means a lightening of the work load, and our success with it and the perfecting of the plate technique will be an appraisal of our interpretation ability and of the method itself.

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